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forms resembling our *Archæocidaris*, *Schizodus* and *Laphophyllum* were picked up, but no echinoderms were found.

All these fossils eventually reached America, and now form part of a collection in Kansas City, Kan. Due to the constant change of station, it was impossible to get in touch with any literature or any person who could help in identifying the specimens. However, correspondence is now going forward with scientists in France with this end in view.

### An Annotated List of Some Kansas Pleurosticti (Scarabæidæ).\*

J. W. MCCOLLOCH and W. P. HAYES.

As a part of the study on insects injurious to the roots of crops being conducted at the Kansas Agricultural Experiment Station, the writers have devoted considerable time to collecting and making observations on the various species of Scarabæidæ belonging to the subfamilies Melolonthinæ and Pleurosticti. Many of these are injurious, in the larval or adult stages, to crops of various kinds. In many cases little is known regarding the distribution, life history, habits and food of the different species. During the past winter the writers have studied all of the specimens of the subfamily Pleurosticti in the collection of the Kansas State Agricultural College and have assembled the notes made by them during the past few years. Most of the literature dealing with Kansas Coleoptera has also been gone over. The present paper is the result of this work and is given at this time in the hope of adding to the meager knowledge of this group and in stimulating others to further observations. The arrangement of Casey (1915) has been followed in listing the species.

*Rhombonalia comes* Casey.

Trego, Russell and Wallace counties. June, July. Casey (1915, p. 6) also reports it from Rooks county.

*Anomala binotata* Gyll.

Throughout the state; common. April, May. The biology of this species in Kansas has been reported by one of the writers (Hayes, 1918).

*Anomala ludoviciana* Schf.

Riley and Gove counties; not common. April, May. Six specimens were in the collection studied. One was taken on a plum tree on May 9.

*Anomala stigmatella* Casey.

McPherson county (Casey, 1915, p. 22).

*Anomala near flavipennis* Burm.

Riley county; not common. June 18 to July 21. Seven specimens have been collected at lights. Adults have also been reared from grubs collected under logs and around corn roots. Pupation occurs June 4 and the pupal stage lasts about fifteen days. Snow (1883, p. 58) reports this species from Douglas county.

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\* Contribution from the Entomological Laboratory, Kansas State Agricultural College, No. 56. This paper embodies the results of some of the investigations undertaken by the authors in the prosecution of project No. 100 of the Kansas Agricultural Experiment Station.

*Anomala flavipennis modulata* Casey.

Ellis county. July 13. One specimen taken along Big creek. Casey (1915, p. 23) reports this subspecies abundant in McPherson and Russell counties.

*Anomala undulata* Mels.

Shawnee and Riley counties; common. June, July. Popenoe (1877, p. 30) lists this species, under the name of *Anomala varians* Fabr., as common in eastern Kansas. The writers have taken this species in flight at 2 p. m. and have reared it from grubs collected in wheat and corn fields. Pupation occurs about June 1 and the pupal stage averages fifteen days. Popenoe (1881, p. 481) reports the beetles abundant in cornfields on the corn leaves associated with *Anomala innubia* Fabr.

*Anomala nigropicta saginata* Casey.

Riley county; frequent. May 12 to June 13. This species has been taken at lights and in the curl of corn plants.

*Anomala innubia* Fabr.

Riley and Shawnee counties; common. June, July. Knaus (1893, p. 294) has found this species in the sand hills near Medora. The writers have reared adults frequently from grubs collected around the roots of corn. Pupation begins early in June and the length of the pupal stage is about thirteen days. Popenoe (1881, p. 481) says that this species is common on corn leaves in company with *Anomala undulata*. This species has been confounded with *Anomala minuta* Burm. in previous Kansas lists.

*Anomala medorensis* Casey.

Pottawatomie, Reno and Wilson counties (Casey, 1915, p. 35).

*Spilota marginata* Fabr.

Nemaha, Shawnee and Riley counties; rare. June, July.

*Spilota lucicola* Fabr.

Kansas (Casey, 1915, p. 46).

*Strigoderma obesula* Casey.

Kansas (Casey, 1915, p. 54).

*Strigoderma obesula quaternaria* Casey.

Kansas (Casey, 1915, p. 55).

*Strigoderma arboricola* Fabr.

Throughout the state, being more abundant westward; common. June, July. Fifty-three specimens were collected in a single day of general collecting at Wallace. Adults were abundant on rose blossoms at Abilene in June, 1919. Life-history studies of this species are now under way. The egg stage was found to average 11.4 days in 1919. Grubs are now being successfully reared in soil with bran and wheat for food.

*Strigoderma viridicollis* Schf.

Wallace and Kingman counties; rare. July.

*Strigodermella pygmaea* Fabr.

Riley and Kingman counties; rare. June 26 to July 13. The Riley county specimens were taken on the sand hills four miles south of Manhattan.

*Pelidnota punctata* Linn.

Throughout the state as far west as Dodge City; common. May 20 to August 1. The adults are very common at lights and have also been taken feeding on wild and cultivated grapes and on spinach. One adult was found in the stomach of a toad. The grubs feed on decaying wood, principally

apple and elm. Over 300 grubs were found in a single apple tree at Anthony in 1918. The life history of this species is now being worked out. Oviposition may begin as early as June 19, the eggs being deposited under logs and probably in decaying wood. The length of the egg stage averages fifteen days. The pupal stage occupies about twenty days.

*Cotalpa subcibrata* Wick.

Western and southwestern Kansas; frequent. May, June. Knaus (1908, p. 91) reports this species fairly common at Medora in 1907 during the last two weeks of May and the first half of June. They were found during the day clinging to the twigs and foliage of the scrub willows growing on the sand hills.

*Cotalpa lanigera* Linn.

Eastern Kansas; not common. May 26 to August 7. The adults have usually been collected at lights. Willow is the only food plant recorded for this species in Kansas. In cages they also fed readily on elm, poplar and cottonwood and very sparingly on maple. Knaus (1901, p. 114) reports it common on willow catkins at Medora.

*Polymæchus brevipes* Lec.

One specimen is in the collection of the State Agricultural College labeled "Kansas." Popenoe (1877, p. 30) records it from Lawrence, and Knaus (1901, p. 112) reports taking two specimens in electric-light globes at McPherson late in July.

*Ochrosidia rufifrons* Casey.

Kansas (Casey, 1915, p. 145).

*Ochrosidia (Cyclocephala) immaculata* Oliv.

Throughout the state; common. June, August. The adults are strongly attracted to lights. Adults have also been found feeding on pigweed, lamb's quarter and gouging into peaches that have fallen on the ground. The grubs are most commonly found in wheat and corn fields, although they have been taken in sod land, alfalfa fields, garden plots and orchards. The life history of this species has been reported by one of the writers (Hayes, 1918) under the name *Cyclocephala villosa* Burm.

*Ochrosidia tenuicutis* Casey.

Wallace county. July. Casey (1915, p. 146) describes this species from Douglas county.

*Ochrosidia prona* Casey.

Wallace county; rare. July.

*Dyscinetus puncticauda* Casey.

Ford and Hamilton counties; frequent. May 11 to August 1. Adults are common at lights. This is probably the species referred to by Popenoe (1877, p. 30) as being "more strongly punctured than *obsoletus* (Lec.), size of *Ligyrrus relictus* (Say), Dodge City." Casey did not have the female at hand in describing this species. The collections studied by the writers show the proportion of sexes to be about equal. The males differ from the females in having the last ventral segment emarginate.

*Dyscinetus trachypygus* Burm.

Ford, Reno, Riley and Shawnee counties; frequent. April 18 to July 21. The adults are frequently found around electric lights.

*Ligyrrodes (Ligyrrus) relictus* Say.

Throughout the state; common. April, August. The adults are common around electric lights and in the soil. They have also been found in drift being carried in the streams after rains. The winter is passed in the adult stage, and in the spring the beetles may be found under manure in

the fields, where mating has been observed to occur. Eggs, which are laid in June, hatch after nine or ten days. The grubs feed in manure and rotten straw and reach the pupal stage from July to October. The semi-pupal stage varies from two to twelve days, with an average of four days, and the pupal stage averages fourteen days, with extremes of nine and nineteen days. There is but one generation annually.

*Euethela (Ligyris) rugiceps* Lec.

Winfield; rare. July 31. One specimen was taken in the soil of a cornfield. This is the first record so far known of this species occurring in this state. This species is a serious pest of corn in some of the Southern states.

*Ligyris gibbosus* DeG.

Throughout the state; common. March-October. The adults are commonly found around lights and at the roots of sunflowers, cockleburrs, celery and sugar beets. The life history of this species has been reported by one of the writers (Hayes, 1917).

*Ligyris bicorniculatus* Casey.

Kansas (Casey, 1915, p. 198). This species is described from a female collected in this state.

*Pseudaphonus pyriformis* Lec.

Russell, Logan and Wallace counties; evidently common in the western part of the state. June, July. One specimen collected in eastern Colorado was taken at the roots of sunflower. On more careful study some of the specimens at hand might agree with some of Casey's new Colorado species of this genus. One unique in the series at hand has an impressed median line on the thorax.

*Aphonus tridentatus* Say.

Western Kansas (Popenoe, 1878, p. 81).

*Strategus atrolucens* Casey.

Sedan; rare. June 20.

*Strategus antæus* Fabr.

Topeka (Popenoe 1877, p. 30); Sedan (Knaus 1905, p. 219).

*Strategus mormon* Burm.

Reno county (Casey, 1915, p. 251). According to Warren (1917, p. 413), *mormon* is a true sand-hill species, where it is found abundantly at Sylvia. He found that the eggs were laid in holes eighteen inches deep, which were then filled with layers of old, dry horse manure. He suspects a three-year life cycle. All specimens were collected from the middle of May throughout the month of June.

*Xyloryctes satyrus* Fabr.

Lyon and Riley counties; rather frequent. April-October. Popenoe (1877, p. 30) reports this species from Lawrence and Topeka.

*Dynastes tityrus* Linn.

Cowley county; rare. July 11. Popenoe (1877, p. 30) lists this species from the Smoky Hill river, and Snow (1883, p. 58) reports it from Chautauqua county.

*Phileurus texensis* Casey.

Riley county; frequent. May, June. Popenoe (1877, p. 30) says it occurs in eastern Kansas. This species is sometimes labeled *P. valgus* Burm. in collections. According to Casey (1915, p. 270) *valgus* does not occur in this country.

*Cotinus nitida* Linn.

Kansas; rare. Popenoe (1877, p. 30) records this species from Neodesha.

*Cotinus nitida ornata* Casey.

Winfield; rare. July. One specimen was taken in a cornfield.

*Euphoria fulgida* Fabr.

Riley, Shawnee, Gove and Ellis counties; common. May-August. The adults have been taken feeding on the blossoms of dogwood, thistle and white clover, on grass in pastures and on ripe peaches and cherries. Popenoe (1877, p. 30) also reports this species on milkweed.

*Euphoria inda* Linn.

Throughout the state; common. April-October. The adults have been taken feeding on sunflowers, plum trees, frosted beans, thistle blossoms and ears of corn. In Kansas this species sometimes injures ripe fruit and ears of corn. The beetles appear in April and May and eggs are deposited during May and June. The egg stage has been found to vary from seven to eleven days. The grubs develop rapidly in manure and soil rich in decaying organic matter. When ready to pupate they construct a cell of earth or dung. Pupation occurs in July and the pupal stage averages fourteen days, with extremes of twelve to sixteen days. Adults reared in July become active early in August. Damage is done at this time to corn and fruits, and the beetles are also found abundant in the blossoms of thistles. The beetles remain active until frost, when they go into hibernation, to reappear the following spring. In a soil cage maintained in a cave during the winter seventeen beetles out of fifty-eight survived. There is but one generation a year.

*Euphoria rufobrunnea* Casey.

Russell, Trego, Wallace and Seward counties; occasional. July, August. Most of the specimens at hand have been collected on weeds.

*Euphoria clarki* Lec.

Western Kansas; fairly common. May-July. The adults frequent flowers, especially those of thistles, into which they burrow.

*Euphoria wichitana* Casey.

Russell, Ellis, Wallace, Kearny and Ford counties; frequent. June, July. Usually taken in blossoms of thistle. This species was originally described from Wallace county.

*Euphoria kerni* Hald.

Throughout the western third of the state; common. June, July. Adults usually taken on flowers, especially those of thistle. Popenoe (1877, p. 30) lists this species as occurring on prickly poppy.

*Euphoria texana* Schauf.

Throughout the western third of the state; frequent. May-July. This species usually occurs on the same plants with *kerni*, and for some time was considered as a black variety of that species.

*Euphoria æstua* Horn.

Riley county; rare. Two specimens are in the collection of the Agricultural College from Riley county, but without further data.

*Euphoria sepulchralis* Fabr.

Riley, Shawnee, Russell and Wallace counties; common. May-October. This species probably occurs throughout the state. The adults have a wide range of food plants, having been taken on the flowers of thistle, golden-rod, dogwood, snow on the mountains, polygonum, sunflower and spirea. They have also been found gouging the fruit of apple, peach and plum, and have been swept from milkweed, grindelia and boneset. The beetles have been taken in the soil of plowed wheat land, in swamp land and on sand hills. A grub of this species collected under dung in a pasture July 19, 1918, pupated August 27, 1918, and became adult September 9, 1918. This grub formed a small earthen cell in which to pupate.

*Euphoria sepulchralis kansana* Casey.

Riley county; at times abundant. September. The adults have been taken on the blossoms of goldenrod. Casey (1915, p. 321) records this subspecies from Muncie, Kan.

*Euphoria sepulchralis cuprascens* Casey.

Riley county; rare. September. Casey (1915, p. 322) describes this subspecies from Medora and suggests that it is probably a local race in this zoologically somewhat isolated region.

*Stephanucha pilipennis* Kr.

Riley, Reno and Gove counties; frequent. May-October. This species seems to be restricted to sand-hill areas. At Manhattan they are numerous during July, flying over sandburs in fields in the sand hills along the Kansas river. They are especially abundant on clear, hot days between 9 and 12 a.m. Regular collections made during the summer of 1902 show that the maximum flight occurred about July 22. Popenoe (1877, p. 30) reports this species under the name *Euphoria areata* Fabr., as occurring on thistle heads in western Kansas. According to Knaus (1899, pp. 37, 38) *pilipennis* is one of the rarest of scarabæids. He found it from May 1 to May 20 crawling sluggishly over the sand at Medora, and suggests that the latter part of April would furnish the best collecting.

*Cremastocheilus canaliculatus* Kirby.

Lawrence (Knaus, 1905, p. 219).

*Cremastocheilus castaneæ* Knoch.

Eastern Kansas (Knaus, 1905, p. 219).

*Cremastocheilus incisus* Casey.

Kansas (Casey, 1915, p. 351).

*Cremastocheilus nitens* Lec.

Riley and Gove counties; common. April-August. Knaus (1901, p. 115) records it from the sand-hill region about Medora. In Riley county this species has been common in pastures and sandy areas. Grubs collected in July and August under logs on a sand flat along the Kansas river pupated the latter part of July and during August. The semipupal stage varied from two to five days, with an average of three days. The pupal stage ranged from nine to eighteen days, with an average of twelve days for sixteen individuals.

*Cremastocheilus knochi* Lec.

Riley and Logan counties; frequent. April-June. Snow (1878, p. 66) also records this species from Gove and Wallace counties.

*Cremastocheilus knochi gracilipes* Casey.

Cheyenne county (Casey, 1915, p. 360).

*Trinodia (Cremastocheilus) saucia* Lec.

Wallace county (Snow, 1878, p. 66); Kansas (Casey, 1915, p. 367).

*Trinodia setosifrons* Casey.

Clark county; elevation, 1,962 feet (Casey, 1915, p. 368).

*Osmoderma eremicola* Knoch.

Riley and Russell counties; frequent. May-August. The adults, larvæ and pupæ have been taken in the decaying stumps of apple trees. Before pupating the larva constructs a spherical cell of bits of wood and refuse.

*Trichiotinus (Trichius) piger* Fabr.

Riley, Pottawatomie and Shawnee counties; common. May-July. The adults have been found feeding on wild rose and sumac. The grubs are found in decaying wood and old logs. Two reared individuals pupated in June and matured June 25 and July 1.

*Trichiotinus (Trichius) texana* Horn.

Riley, Pottawatomie and Dickinson counties; frequent. June. The adults have been taken on Jersey tea in bloom and on rose blossoms in company with *T. piger* and *Strigoderma arboricola*. They are also attracted to lights.

*Valgus squamiger* Beauv.

Eastern Kansas; comparatively rare. May. The record of Popenoe (1877, p. 30) concerning *V. canaliculatus* Fabr. probably refers to this species. He says it occurs under logs and in rotten wood. Snow (1881, p. 78) lists this species from Leavenworth county.

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### A Preliminary Study of the Life History and Habits of *Dione Vanillæ* Linn.

VANCE RANDOLPH.

Some years ago, becoming interested in certain problems connected with the life history of *Dione vanillæ*, I skimmed the scanty literature available, made some observations, and took some fragmentary notes. Having abandoned the study, and being at present occupied with other matters, I am placing this material in the hands of Dr. O. P. Dellinger, to whom I owe my interest in the subject, thinking that perhaps the investigation may sometime be continued by some of his students.

As most of the data was collected near Pittsburg, Kan., all spatial references are to this locality unless some other is specifically indicated.

#### CLASSIFICATION.

The genus *Dione* Hübner (*Agraulis* Boisduval and LeConte) is confined to the New World. It is classed in the subfamily Nymphalinæ between the genus *Colenis*, from which it is distinguished by the larger palpi, and the